Public Telephone Control with Voice Over Internet Protocol Transmission

Field of the Invention

This invention relates to the control of public telephones at a given site and the processing of voice telephone calls with the calls being routed over Voice over Internet Protocol networks.

Background of the Invention

With typical coin operated public telephones a caller manually dials appropriate information over transmission means, such as local wire loops connecting to a computing and switching means called a "central office switch," which first collects the dialed caller information, processes the call, and controls the switching, accessing, and routing of caller information over long-distance transmission means to other similarly-arranged computing and switching means that are remotely located. In the past voice telephone calls were connected to a human operator to provide assistance in accounting and billing for a call. Access over additional long-distance transmission means was provided to a last computing and switching means connected to the local loop of a destination telephone terminal instrument and various computing and switching means which record the call numbers and timing and further arrange the accounting and billing for the public telephones and calls.

U.S. Patent 4,935,956 , Hellwarth, et al. describes a public phone service that permits and arranges long distance calls, the charges of which can be billed to either a credit account, the called party, or to a third party with a computer recording and accounting for the revenues collected from the telephone service. This is an example of a controlled public telephone system.

Telephone instruments which are accessible to the public for placing telephone calls are used in locations which are accessible to persons who are not necessarily responsible for their use. Often, public telephones are located in areas where restrictions must be placed on their use. For example, in prisons limitations are placed on the destination telephones which may be called. In order to control the destination numbers it is necessary to detect attempted three-way calls. U.S. Patent 5,768,355, Salibrici et al., shows a three-way call detection system which uses digital signal processing to identify a third party connection. The three-way call detection of this patent is used in the Commander™ telephone system supplied by Science Dynamics Corporation. This is another example of a controlled public telephone system.

Recently, voice over internet protocol (VoIP) has been used for transmitting packets of data representing voice telephone messages. A VoIP gateway permits VoIP sessions to be conducted with called parties such as a called party having a PC connected to a Public Switching Transmission Network (PSTN) by a telephone line.

It is an object of the present invention to use Voice over Internet Protocol networks to transmit information from a controlled public telephone system.

Summary of the Invention

In accordance with the present invention a controlled public telephone communication system has a plurality of telephones at a given site and a programable computer for switching, accessing, routing, timing, billing, and the control of the telephones. The telephones are selectively connected to an off site switched telephone network over a Voice over Internet Protocol network.

Further in accordance with the invention the programming for the computer is not all performed by the computer at the site. The system of the present invention distributes the processing to remote locations over an Intranet or Internet network. In accordance with the invention the distribution of the data processing to remote locations is integrated with the distribution of telephony signals over the Voice over Internet Protocol network.

Further in accordance with the invention, the processing of three way call detection is moved beyond the VoIP network so that signal loss or degradation by VoIP does not interfere with three way call detection.

The foregoing and other objects, features and advantages of the invention will be better understood from the following more detailed description and dependent claims.

Short Description of the Drawings

Figure 1 shows a block diagram of a controlled public telephone system of the present invention;

Figure 2 shows prior art public telephones at a single site;

Figure 3 shows prior art multiple site public telephone systems;

Figure 4 shows the ability of the invention to access software functions over a data network;

Figure 5 shows the same ability as Figure 4 but shows that the VoIP and data network are the same;

Figure 6A depicts a prior art control computer; and

Figure 6B shows the modifications to the control computer necessary to provide VoIP and data network capability.

Description of the Preferred Embodiment

Figure 1 shows a controlled public telephone communication system including a plurality of public telephones 10 at a given site. The site may, for example, be a prison in

which the use of the public telephones is monitored and controlled. Other sites for application of such control include hotels, airports, convention centers, or any location both public and private which contains a plurality of public telephones. A programable computer 12 at the site is provided for switching, accessing, routing, timing, billing and the control of the telephones 10 at the site. Telephones 10 are connected to computer 12 by wire lines 14. The computer 12 may be of the type shown in US Patent 4,935,956, Hellworth or of the commercially available type provided by Science Dynamics Corporation under their Commander™ designation.

Computer 12 has a modem which establishes a connection to a desired Public Switched Telephone Network ("PSTN") 16. The PSTN is any of those provided by AT&T, GTE, a Regional Bell Operating Company and others comprising multiple switching offices. As is known in the art, a Public Switched Telephone Network ("PSTN") includes a hierarchy of telephony switching offices. Individual subscribers are accessed on "local loops" or individual telephone lines to a nearby telephone exchange called an "end office" also called an "end telephony office". One or more end offices may be accessed to a "local central office," also called a "local central telephony office" or accessed to a "toll office." An end office may also function as a local central office (e.g., in a remote area or rural area). Alternatively, the system can terminate in a Private Branch Exchange instead of the PSTN.

In accordance with the present invention the telephones 10 are selectively connected to the off site switch telephone network 16 over an Internet Protocol (IP) network 18 which includes a Voice over Internet Protocol (VoIP) gateway 26. The Internet Protocol (IP) may be a Wide Area Network (WAN) or a local area network (LAN). Computer 12 selectively connects the telephones with the Voice over Internet Protocol gateway 26. The Internet Protocol ("IP") is a routing protocol designed to route traffic within a network or between networks. Voice-over-IP is a method for providing voice capabilities over an IP network such as the internet or an intranet. In such networks data packets are sent to and from communication sites to facilitate communication. In communication systems utilizing a Voice over Internet Protocol (IP) protocol, these packets are commonly referred to as datagrams. In typical Voice over IP networks, each communication site sends datagrams to other communication sites. There are different approaches to sending datagrams.

The control computer 12 supports a variety of applications, such as remote configuration, management and back-up, bandwidth allocation and control, least cost routing, Voice over Internet Protocol (or Voice over IP), as well various telephony related applications. In certain preferred embodiments, control signals per ITU recommendation H.323, and audio based media streams using RTP per Internet RFC1889 are applied. Alternatively control signals could be applied using other protocols such as SIP per Internet RFC 2543.

Figure 1 shows that the computer 12 performs the function of switching, indicated at 20, routing, indicated at 22, and billing, indicated at 24. Typically a prison environment such as is described in the example has rules and regulations regarding what each inmate is allowed for telephone usage. The telephone user first dials a calling card number and a PIN code which is checked at 28. A calling card number is associated with the PIN code. Control computers such as the Commander™ have stored therein the restrictions on telephone usage associated with that PIN number. As an example, on Monday the inmate may be allowed to call his attorney or to call his mother. As part of the restriction on telephone usage the Commander™ provides a three-way call detect system 30 as described in the aforementioned Salibrici et al. patent. This is one of the restriction imposed by control computer 12.

Voice data is processed by means of a vocoder (Voice Coder/ Decoder). This process utilizes one of several standard schemes such as ITU recommendation G.723.1, G.729, or G.711 among others. VoIP Gateway 26 is provided to service and control Voice over IP ("VoIP") communications. Various types of VoIP communications may be effectively managed and controlled in accordance with preferred embodiments of the present invention.

TRS 06/26/2001

Figure 2 depicts the prior art in which four public telephones at a single site are connected through a Commander™ unit 32 to a central office 34. Figure 3 depicts four sites 36, 38, 40 and 42 each of which has a plurality of Commander™ units connected through hubs 44 to a router 46. The router 46 routes calls to a server 48 which connects the calls to central office 34.

In accordance with the present invention, lower cost and efficiency are obtained by operating systems such as shown in Figures 2 and 3 over Ethernet and Voice over Internet Protocol networks. For example, each prison in a state wide prison system has Commander™ units such as shown in Figure 3. There may be a thousand phones but all of the phones are

connected through Commander™ systems over Voice over Internet Protocol network. Often large administrative systems such as this have existing data networks which process and transmit e-mail and the like. Providing a control computer such as the Commander™ with a VoIP gatekeeper and Ethernet capability allows the public telephone systems at various sites to be integrated into the data network easily.

Figure 4 shows how the programming of control functions may be distributed to remote locations over the Ethernet network. In Figure 4 the routing function 22, the billing function 24 and the PIN Checking 28 are distributed to a remote location or locations by the Ethernet network 50. As shown in Figure 4, the network 50 is a local area network (LAN). However, these functions may also be distributed over a WAN. The distribution of these functions to remote locations has the advantage that the functions can be centralized with the functions being performed at a central administration location.

The distribution of a control function is accomplished with programming based on software architecture such as BubbleLINK® and equipment with the ability to enable a seamless connection between traditional circuit-based networks and newer digital packet-based networks. Such equipment includes the Integrator C-2000® series of IP Telephony Gateways and the Commander II Inmate Control phone system (also based on the Integrator C-2000® architecture). The control functions include a wide array of editable call control parameters, advanced call monitoring, real time call recording and three way call fraud detection.

Figure 5 shows the integration of the VoIP and data networks. In this case the telephone communication is integrated into the data exchange network. Figs. 4 and 5 also show that the three way call detection 30a is moved from the site, i.e. in the control computer 12 as indicted at 30, to a point beyond the VoIP network. VoIP transmission requires voice compression and packetizing. These operations are lossy and detrimental to the ability to perform three way call detection. Therefore, three way call detection is performed at 30a after the telephony signals have been decompressed and depacketized by the VoIP gateway 26a.

Figure 6A depicts a prior art Commander™ control computer 13 which has software50 for performing the functions of call processing, switching, and control. It has station interface hardware 52 which provides an interface with the telephones 10. It has a digital signal processor 54 for processing signals from the telephones 10 as programmed by the software 50. PSTN interface hardware 56 provides an interface to the PSTN switch 16.

compressor and packetizer 58 have been added to produce compressed data packets from the telephony signals. These are the principal functions of the VoIP Gateway 26. The packets are processed in the Ethernet network interface 60 so that they can be applied through the WAN 18, or a LAN, to the VoIP Gateway 26a. The telephone signals are decompressed and depacketized by VoIP gateway 26a and distributed to a public switch. Preferably, three way call detection is performed at this point by three way call detect system 30a.

Mixed modes providing both Local access wire circuits (analog or digital) and VoIP may be used. The local access circuits transport local calls at fixed lower rates to a Local Exchange Carrier (LEC), while the VoIP portion tranports higher cost long distance calls to an Inter-Exchange Carrier (IXC). By connecting a plurality of sites on the WAN, multiple sites could share a common set of local access circuits. The sharing of local access circuits is called 'Edge Routing'. The Edge Routing negates the need for local access circuits at each facility.

While a particular embodiment of the invention has been shown and described various modifications may be made. The appended claims are, therefore, intended to cover all such modifications within the true spirit and scope of the invention.